

Beetle
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PLAN AND INSTRUCTIONS FOR THE BECHLER
RIVER MOUNTAIN PINE BEETLE CONTROL PROJECT

Prepared by
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Approved _____, 1931.

George F. Baggley
Chief Ranger.

INTRODUCTION:

Yellowstone Park is now dealing with the first major insect control project in its history. The knowledge that a dangerous invasion of mountain pine beetle threatens to consume the lodgepole forests of the park has reached the public, who will be watching the results of the control measures instigated, with a severely critical eye. The "ghost forest" of Crater Lake National Park, where there are thousands of acres of standing dead trees, is a forceful reminder of the ravages of this insect, once it becomes uncontrollable. The Targhee National Forest, which borders Yellowstone Park on the southwest, has spent three years and many thousands of dollars combating the infestation which has slowly migrated towards and finally reached the forests inside of the park boundary. The entire Falls River Basin, one of Yellowstone's few remaining wilderness areas, is in danger if this infestation is not checked immediately.

The life habits of the insect are such that control measures are practical only for a short period during the spring and fall. Any beetles that escape in the spring attack new trees during the summer and multiply very rapidly. Small areas or groups of infested trees appear far in advance of the original infestation, and become more and more difficult to treat. This is true of the mountain pine beetle in an epidemic stage and this is the condition which we are striving to stop at the start.

Too much stress cannot be placed upon the importance of combating this infestation thoroughly, and combating it thoroughly upon its first appearance is the determining factor in successfully eradicating the pest.

The Yellowstone National Park mountain pine beetle control project will undoubtedly be one of the most important to be recently undertaken. The aesthetic safety of one of the world's greatest playgrounds, and of an American heritage, is threatened. No effort must be spared in attempting to completely suppress this depredation and a definite plan of organization must be instituted if efficient results are to be obtained. The purpose, therefore, of these plans and instructions ~~is to~~ stress the importance of this fact and to aid the officers charged with the responsibility of the Bechler River Control Project in securing these results.

The methods of control herein outlined have been submitted by Mr. James C. Evenden, Entomologist in Charge of the Couer d'Alene, Idaho, Forest Insect Field Station, and are applicable to the situation we are confronting at Bechler River.

PURPOSE OF PROJECT:

The purpose of this project is to secure 100% control of the mountain pine beetle infestation throughout the working units herein described. In brief, treatment of every infested tree and treatment of every beetle in the infested trees in each working unit is the definite aim of this project.

ORGANIZATION:

The personnel of this project shall consist of one camp manager, fifteen spotter-burners, three packers, one teamster, one cook and flunky. At any time, however, the personnel may be increased or decreased at the discretion of the Forest Assistant or Chief Ranger. A permanent Park Ranger shall act as camp manager and be responsible to the Forest Assistant or Chief Ranger for the proper conduct of all phases of the work. The remaining personnel will in turn be directly responsible to the camp manager for the proper performance of the duties to which they are assigned. Permanent park officers assigned to this project will act as crew foremen as directed by the camp manager, and will be in charge of and responsible for the work of the spotting-burning crews.

The organization shall be divided into three separate crews of six men each. One crew foreman, four spotter-burners and one packer shall comprise a crew. The practice of assigning park officers to crew foremanship, so that each officer assigned to this project shall receive some experience in this capacity, will be followed, but since there will be only three crew foremen at a time the remaining park officers will act as spotter-burners until assigned to crew foremanship.

DUTIES OF THE PERSONNEL:

Camp Manager. The responsibility of all phases of the work rests upon the camp manager. He will spend a good portion of his time in direct supervision of the work of the treating crews. Very close supervision is extremely important to avoid carelessness in spotting and treating of trees, wasting of oil and delays which are unnecessary. The short working season and importance of efficiency require the maximum speed and accuracy of every member of the organization. The need for close supervision, therefore, is readily apparent.

The camp manager will order all supplies, keep records of all equipment, time slips, change of personnel, if any, progress reports, weekly reports, --in brief, he will manage all phases of the field work.

Crew Foreman. The crew foreman will be in charge of the spotter-burners and packer assigned to his crew, and will give orders regarding the procedure of his crew. He will run the compass line, and pace the distance traveled, as elsewhere described in this plan, and will keep a daily and weekly record of the activity of his crew--number of trees treated, method of trees treated, acreage or mileage covered, etc.

Spotter-Burners. The work of the spotter-burners is as the name implies, spotting or locating the infested trees and burning them according to the methods herein outlined. It is of great importance that these men become thoroughly familiar with the technique of spotting and the different methods of burning, as well as the conditions determining the method of burning to be used.

Packers. Each packer will be equipped with two or three pack horses, one saddle horse and the necessary equipment to pack oil, tools,

water, etc., to the spotting-burning crews. One packer will be assigned to each crew and he will assist in the treating of trees by having oil and tools available at all times, aiding in filling sprayers with oil, etc. He will care for his stock and have the horses saddled and ready to go before breakfast to avoid delay of the crew. He will assist in moving camp if so directed by the camp manager.

Teamster. The teamster will haul oil, etc., as directed by the camp manager. He will assist in moving and setting up camp, haul wood and supplies, and be at the disposal of the camp manager for any necessary camp maintenance.

Cook. The number of men at mess may vary, so no definite sized crew may be expected by the cook. He will cook for the entire organization and be expected to provide a neat and clean mess. He will notify the camp manager of his needs for groceries, etc. each day and if so directed by the camp manager he will keep a daily record of meals served. He will be prepared for and have material on hand for putting up lunches each day, but will only be expected to furnish the men with this material so they may proceed to put up their own lunches. He will serve meals at hours determined by the camp manager and at the discretion of the camp manager these hours may be changed; that is, if it is deemed necessary to begin work at daylight to offset wind conditions, the camp manager will arrange the schedule accordingly.

Flunky. The flunky will serve meals, wash dishes, supply the cook with wood, water, etc. He will be at the cook's disposal where assistance is needed.

AREA TO BE COVERED:

The area to be covered this season is divided into three units. The units are outlined so that the most dangerous areas may be worked first in order, leaving definite boundaries for future work and covering what appears to be the maximum acreage workable during one burning season.

Rock Creek Unit. This unit covers approximately five sections, or 3200 acres, and is bounded by the west and south boundaries of the park, Robinson Creek Trail and Robinson Creek. It is believed that this unit is the most dangerous and should be worked first. Camp may be established close to the park boundary on Rock Creek to benefit by an accessible road.

Robinson Creek Unit. This unit covers approximately two sections or 1280 acres, and is bounded by the west boundary of the park at the north of Rock Creek unit, and the extreme edges of the mature stand of timber on Robinson Creek as shown on the type map. This area appears to be the second most dangerous section and should be worked as soon as the Rock Creek unit has been completed.

Camp will either be established on the Forest Reserve close to the park boundary on Robinson Creek or at a more suitable location inside the park. The first mentioned location is accessible by wagon, but it may

be found practical to pack camp into the unit from Bechler Ranger Station.

Wyoming Creek Unit. Approximately three and one-half sections, or 2240 acres, is covered by this unit, and it is bounded by a north and south line one-half mile east of Wyoming Creek, which runs from the south boundary of the park to the Bechler Meadow road. From this point on the Bechler Meadow road an east and west line is run to the Robinson Creek Trail. The west boundary of the unit follows the Robinson Creek trail to the Bechler Ranger Station and then follows the Bechler road to the park boundary. This unit should be worked last. Good camp sites are accessible by car near the center of the unit.

Where there are no natural unit boundaries, lines will be run with compass and blazed well to establish boundaries, as directed by the camp manager.

METHOD OF CONTROL:

The method of control which will be used on this project is a combination of spotting and treating at the same time, rather than making two separate operations of it. This eliminates the "follow-up", or treating crew; and because of the scattered nature of the infestation it is believed that more satisfactory results will be obtained from this method.

The crew foreman will run the compass lines on the area assigned to him and the spotter-burners will work abreast of him inspecting the trees on strips one chain wide. The crew will preferably work in a "geese flight" formation as this is found advantageous in accurately determining one chain distances. The packer will follow closely behind the crew with oil, sprayers, tools, etc. and when an infested tree is located the man locating it will shout "Bugs". This will be the signal for the crew to halt and treat the tree or trees necessary before proceeding farther on their lines. The crew foreman will keep a record of the number of trees treated, approximate location and other details as listed on a form which will be supplied for this purpose.

INSTRUCTIONS FOR SPOTTING:

In all forest insect control projects, spotting is the first and most important step of the operation. A large per cent of the infested trees which are missed by the spotters will remain untreated, leaving a potential source of reinfestation within the area, which often defeats the purpose of the project. In addition to the potential danger of such trees, and after the project has been put to the expense of establishing a camp within an area it is economically essential that all infested trees within the area covered by the survey be treated. In brief, then, it is the duty of the spotter-burners to locate and treat, as efficiently and economically as possible, all infested trees within the areas assigned to them.

The insect we are combating is known as the mountain pine beetle (Dendroctonus monticolae), which attacks and kills healthy, mature western

white pine, western yellow pine, lodgepole, sugar pine, white-bark pine, and sometimes Engelmann spruce when in association with infested pine. The adult insects are rather stout, black, cylindrical barkbeetles, varying in length from $3\frac{1}{2}$ to $6\frac{1}{2}$ of an inch. These beetles bore through the outer bark and construct long perpendicular egg galleries directly beneath the bark, which slightly groove the wood and extend up the tree. At the bottom or start of these galleries, which vary in length from 12 to 30 inches, there is normally a slight crook of an inch or more. Eggs are deposited along this gallery which soon hatch into small white grubs or larvae. In feeding, these larvae excavate individual larval mines at right angles to the egg gallery, which vary in length and width, and are exposed on the surface of the inner bark. When mature the larvae construct a small cell at the end of the larval mine in which the transformation to the new adult takes place. During this transformation the insect goes through what is called the pupal stage, and the small cell is termed a pupal cell.

When the transformation is complete the new adults bore away the intervening bark between cells and congregate beneath the bark for some time before emergence, or they may bore emergence holes directly out from the pupal cells. When emerging after congregating several insects may use the same emergence hole, or quite often advantage is taken of cracks in the bark, woodpecker work, etc.

Insect-attacked trees are first located by the presence of small pitch exudations (pitch tubes) which form at the mouth of the entrance hole, or by the boring dust at the base of the tree. Pitch tubes are not always present. When the attack is extremely heavy there are very few, if any, to be seen, so one cannot depend upon this rule as an infallible guide. This is easily explained by the fact that the total flow of pitch is distributed through so many entrance holes that there is not sufficient to form tubes. On the contrary, when the attacks are light, the flow of pitch is so strong that the attacking beetles are washed from their galleries and the attack is unsuccessful. Large pitch tubes are usually, though not always, an indication of a pitched-out attack. Fresh woodpecker work is a true indication that there were and possibly are insects beneath the bark. However, it does not prove that the insect is the mountain pine beetle. Later in the season the foliage of the infested trees begins to fade, which can be used as a guide to infested groups. This may occur in some areas in the fall, but by April or May a large per cent of white pine trees attacked the previous season will show discolored foliage.

There is no infallible rule which can be given to you for the proper marking of infested trees from external evidence. The rules which have been listed will lead you to the tree that has been attacked, then it is for you to determine if it should be treated. It will be necessary for you to examine nearly every tree by removing a piece of the bark. If you find that the tree was killed by the mountain pine beetle and that there are insects beneath the bark, then it should be treated.

It is in the marking of trees for treatment which show external evidence of attack that the good judgment of the spotters must be called upon. In this connection it is necessary that the spotters have a general idea of

the seasonal history of the mountain pine beetle. The manner in which this insect works has been described to you so that in a very short time you can determine if the tree has been attacked by this insect. However, it must then be determined if the insect broods are still present beneath the bark before the tree can be marked for treatment, as it is very obvious that there would be little accomplished by peeling trees from which the beetles had emerged.

Though there is but one generation of the mountain pine beetle per year, an overlapping of the broods does occur which often causes confusion to the spotters. Normally the insect passes the winter as a larva which matures into a new adult during June and emerges in July. However, deviations from this rule are often encountered and broods are often found overwintering in the egg and new adult stage. During long seasons the insect broods from early attacks often mature and pass the winter as new adults instead of larvae. These new adults emerge during June and attack new trees so that during the course of a project where trees containing overwintering larvae are being treated, one will often encounter trees with new adults, as well as new attacks. Such trees are always in the minority and serve as the exception rather than the rule, but their occurrence often confuses the spotters.

Another complication which may be encountered is when the attack only exists on one side of the basal portion of the tree. Infested trees of this character are often missed by the spotters passing by the unattacked side of these trees, but the most serious complication or confusion which will arise from these trees is when the uninfested portion of the tree is attacked later in the season, or the following season. This results in the spotters finding insect broods in this basal portion of the tree when the insects have emerged from the remainder. With a little practice these trees can be easily determined, and passed without marking. The fact that the foliage has fallen from the limbs with the general condition of the trees will indicate that the insects are to be found in the base only, usually on one side, and that by the time the spotter's examination has been completed the tree will have been treated.

INSTRUCTIONS FOR TREATING:

There are two methods for treating infested trees, namely, the felling-burning and the standing-burning methods. The felling-burning method consists of cutting the tree or group of trees, lopping off the limbs, sawing the tree into convenient sized logs, ricking the logs, piling on the branches and setting afire. In many cases the infested tree can be felled, soaked with oil and successfully burned where it lies. Both of these burning procedures are found to be practically 100% efficient. When trees are felled, however, the stump must either be completely peeled or very thoroughly burned to kill what beetles remain in them. The standing-burning method consists of spraying oil or gas-oil thoroughly over the bole of the tree to its infested height and then setting it afire.

The determining factor which will decide which tree shall be felled and which burned standing is based upon what can be seen of the

height to which the individual tree is infested, and the height to which the individual infested tree can be burned. For example, the smaller diameter trees are almost sure not to be infested higher than they can be burned successfully standing. Even large trees may in many cases be burned successfully where witches broom and large branches assist in crowning the tree out. However, there is no definite way of knowing which tree must be felled and which can be successfully treated by the burning-standing method except by careful observation of each individual tree. Weather conditions are a determining factor in deciding which method to use. Cold damp days following a storm or during a storm and windy days make the burning-standing method of treatment impractical. On days of this kind the felling-burning method should be practiced exclusively. Also, on afternoons when the wind comes up the crews should be equipped to proceed with the felling-burning treatment.

Standing-burning Treatment. The object to be obtained in this method is to generate sufficient heat on the bark of the tree to kill the developing broods of young beetles which are working between the bark and the wood.

The equipment used consists of compressed air sprayers of four gallons capacity equipped with carrying strap, oil resistant hose or metal tubing connections to an automatic shut-off and a long nozzle having an aperture the size of a No. 55 drill. Careful experiments have demonstrated that this size and form of nozzle gives best results with the oil. The light fuel or gas oil used has somewhat the burning qualities of kerosene. In timber where the infested portion extends much beyond 20 feet high, particularly where the boles are clean and free from limbs, it is necessary to use steel extensions which are made in sections three feet long. By coupling three of these together the oil may be thrown somewhat in excess of 30 feet high. Cases are provided so that several sections of the extensions may be carried with the pack outfit supplying the burners with oil.

The tanks are filled about three-fourths full of the oil and pumped up to a moderate pressure. Too high pressures cause breaking up of the oil stream. A few tests will give the burner an idea of the feeling of the pump when the most effective pressure is obtained, which is about 20 pounds, and as far as possible this pressure should be maintained at about this point. For most men the tank is carried more effectively on the left shoulder at an angle of about 35° with the body. The automatic shut-off is operated by the right hand. The oil is rather caustic and will blister the skin if it comes in contact with it to any considerable extent. For this reason the clothing should be such as will give good protection and spilling of the oil on the clothes or hands should be avoided as far as possible. Burners are required to carry a large rag along to wipe the oil off of the outside of the tank after filling. The rag can be carried between the lower end of the strap and the tank where it will dry out sufficiently for long use. Plenty of extra clothing should be available to allow frequent changing since more or less spattering with oil is unavoidable. Unguentine should be used freely where burning has occurred. Precautions should be taken to see that oil soaked clothing does not become ignited.

Before starting to throw the oil on a tree note should be made to see that there is sufficient oil and air pressure to complete the application. A stream of oil is directed against all parts of the trunk up as far as there is any indication of insect work, care being taken to distribute it evenly and avoid spattering. The base of the tree often has thicker bark and particular care must be taken to soak this section thoroughly. Since it is desired to create intense heat and burn out the entire top, if possible, advantage should be taken of any heavy or dry limbs close to the trunk and oil sprayed on them. If two or more trees to be treated stand close together they should be sprayed and burned at one time since added heat and a better burn results. After the trunk has been soaked throughout added pressure is pumped in the tank if necessary and a lighted match thrown at the base of the tree. As the flame starts, additional oil is sprayed on to build up as much volume of flame as possible and this is carried on up the tree. A good flame developed at first results in a hotter burn and more frequent crowning out with less oil than if the fire starts slowly and it is necessary to attempt to build up the flame after the bark has been partially burned.

Where there is any doubt about the treatment reaching high enough to kill all the bugs the extensions should be used. It is much more effective to use them and burn out the tree at one burning than to have to go back and attempt to burn out the top after the lower part is burned. Sometimes poles or brush placed against the base of the tree helps to carry the fire up. Do not hesitate to ask the crew foreman whenever there is any question regarding whether or not the burning is being properly done. Cold winds greatly retard the effectiveness of treatment and it may at times be advisable to burn in the evening or at night where such interference becomes serious. The same action may be necessary towards the later end of the treating season when danger of the fire running develops. General action to prevent fire spreading may be avoided by taking advantage of the early morning or evening hours to burn certain sections having bad fire conditions or those where the wind strikes. These may often be treated following rains or showers.

Care and attention to details in this matter develop the skill of the burner and enable more efficient burning to be accomplished with the expenditure of less oil and a constant effort to improve the quality of one's work should be made. There are many details which cannot be covered in a memorandum of this nature and much depends on the individual efforts of the burners to make the work effective with the least possible expenditure of oil and time. All the packing, mapping and spotting, in fact all the results of the entire effort are dependent upon the efficiency of the burning operation.

Summary for Effective Work

Avoid: Wasting oil;
 Useless treatment;
 Skipping infested sections;
 Insufficient heat at base;
 Missing any bug infested tree;
 Lighting before you are ready.

Do: Reach all infested sections of the tree;
 Distribute the oil evenly and thoroughly;
 Make sure you have oil and air pressure to
 build up heat after lighting;
 Build up a quick heat;
 Make sure the heavy bark at the base of the
 tree is well treated.

GET ALL THE BUGS

Remember we may have 10 infested trees next
year for every one we miss this year.

EQUIPMENT:

Camp Equipment. Office tent, sleeping tents, mess tent, stoves
for tents, cook stove, kitchen equipment, extra bedding, grindstone, files,
rope, nails, first-aid kit, extra axes, etc.; horses and equipment, horse
feed, etc.

Spotting-treating Crew Equipment. (6-man crew)

Report forms
1 compass, F. S. Standard
1 talley register
1 map of forest area
5 hand axes with sheaths
3 spray tanks
2 9-foot extensions
1 extra nozzle (with crew)
1 extra hose (with crew)
1 extra nozzle parts (with crew)
Extra gaskets (all sizes, with crew)
1 light felling saw
2 light axes
2 pack horses
Oil tanks to carry oil
Rack to carry spray tanks when not in use.

Camp Manager's Equipment.

Time book
Time slips
Stationery
Envelopes
Camp Manager's weekly report
Crew Foreman's weekly report
Pencils
Drawing board
Maps
Extra equipment

The Camp Manager will be responsible for and keep a record of all
equipment.

CARE OF EQUIPMENT:

It will be the duty of each man in each crew every night to see that all equipment used by the crew is in workable condition so that all unnecessary delays will be avoided. In the course of the field work there will be a certain amount of wear and tear on equipment and occasional loss. Such damage or loss when properly explainable will be excused but when due to carelessness, payment therefor will be required.

CAMP RULES:

It is suggested that each member of the organization keep his personal equipment in duffle bags or strong seamless sacks. Moving camp is an expensive and laborious task and it is not possible to haul trunks and excess baggage.

Any preparation for the following day's work such as repairing pumps, sharpening axes, etc. should be made in the evening so that the crew will not be delayed in starting out in the morning.

All camps will be kept and left in a neat and sanitary condition, and refuse will be burned or buried. A pit will be dug at each camp for the disposal of garbage, and care will be taken against the pollution of any streams or springs.

FINAL REPORT:

A report covering the details of the project will be made out in the Chief Ranger's office from the records kept by the camp manager.

CAMP MANAGER'S WEEKLY REPORT

Project _____ Unit _____ Camp _____

Production Record for Week of _____ to _____

Day	Crew		Crew		Crew	
	Trees Treated	Man-days	Trees Treated	Man-days	Trees Treated	Man-days
S						
M						
T						
W						
T						
F						
S						
TOTAL						

Grand total trees spotted _____ Grand total trees treated _____

Meals Served

Day	Number
S	:
M	:
T	:
W	:
T	:
F	:
S	:

A. Total effective man-days treating _____

B. Total effective man-days spotting _____

C. All other man-days _____

D. Total man-days paid _____

E. Total man-days contributed _____

Total : _____

A, B, and C should equal D and E.

Remarks: _____

Signed _____

Camp Manager

- A. Includes Crew Foreman and all men contributing to the actual treating of trees
- B. Includes Chief Spotter and all men of spotting crew.
- C. Includes Camp Manager, Cooks, Flunkey, Bull Cook, etc.
- D. All man-days paid from project funds.
- E. All contributed man-days except supervising overhead not attached to camp.

TREATER'S WEEKLY REPORT

Week of _____ to _____

Crew Symbol _____

Project _____

Unit _____

Record of Trees Treated

Day	Number of Trees Treated	Section or Area Worked	Man-days	Area	Remarks
S					
M					
T					
W					
T					
F					
S					
TOTAL					

Remaining territory to be covered from present camp _____

Number of days required to complete present camp area _____

Remarks (suggestions, requirements, etc.) _____

Signed _____
Chief of Treating Crew